

CLAIMS

We claim:

1. A process for the catalytic partial oxidation of a hydrocarbon feedstock, comprising:
contacting a feed stream comprising a hydrocarbon feedstock and an oxygen-containing gas feed stream with a monolithic porous metal catalyst at conversion-promoting conditions effective to produce an effluent stream comprising carbon monoxide and hydrogen,
wherein the catalyst comprises unsupported rhodium.
2. The process of claim 1 wherein the catalyst comprises a monolithic foam.
3. The process of claim 2 wherein the foam has 75-90% by volume pores and 20-100 pore size.
4. The process of claim 1 wherein the catalyst further comprises platinum.
5. The process of claim 1 wherein the catalyst is pretreated by exposure to air under conditions sufficient to oxidize the catalyst.
6. The process of claim 1, further comprising preheating said feed stream to a temperature of at least about 30°C.
7. The process of claim 6 wherein the feed stream is preheated to a temperature between about 50°C and about 700°C.
8. The process of claim 7 wherein the feed stream is preheated to about 400°C.
9. The process of claim 1 wherein maintaining the reaction zone further comprises maintaining pressure in said reaction zone between about 500 kPa and about 2800 kPa.

10. The process of claim 1 wherein the molar ratio of methane to oxygen is from about 1.5:1 to about 2.2:1.
11. The process of claim 1 wherein the hydrocarbon feedstock comprises at least about 50% by volume of methane.
12. The process of claim 1 wherein the carbon selectivity for carbon monoxide is at least about 80 %.
13. The process of claim 1 wherein the hydrogen selectivity is at least about 60%.
14. The process of claim 1 wherein contacting the feed stream with the catalyst passing the feed stream over the catalyst at a space velocity from about 150,000 to about 10,000,000 NL/kg/h.
15. A process for the catalytic partial oxidation of a hydrocarbon feedstock, comprising:
contacting a feed stream comprising a hydrocarbon feedstock and an oxygen-containing gas feed stream with a monolithic porous metal catalyst at conversion-promoting conditions effective to produce an effluent stream comprising carbon monoxide and hydrogen;
wherein the catalyst comprises unsupported rhodium, the carbon selectivity for carbon monoxide is at least about 80 %, and the selectivity for hydrogen is at least about 60%.
16. The process of claim 15 wherein the catalyst comprises a monolithic foam.
17. The process of claim 16 wherein the foam has 75-90% by volume pores and 20-100 ppi pore size.

18. The process of claim 15 wherein the hydrocarbon feedstock comprises at least about 50 % methane by volume.
19. The process of claim 15 wherein the catalyst further comprises platinum.
20. The process of claim 15 wherein the catalyst is pretreated by exposure to air under conditions sufficient to oxidize the catalyst.
21. The process of claim 15, further comprising preheating said feed stream to a temperature of at least about 30°C.
22. The process of claim 21 wherein the feed stream is preheated to a temperature between about 50°C and about 700°C.
23. The process of claim 22 wherein the feed stream is preheated to about 400°C.
24. The process of claim 15 wherein said contacting is carried out at a pressure between about 500 kPa and about 2800 kPa.
25. The process of claim 15 wherein the hydrocarbon feedstock contains methane and the molar ratio of methane to oxygen is from about 1.5:1 to about 2.2:1.
26. The process of claim 15 wherein the hydrocarbon feedstock comprises at least about 50% by volume of methane.
27. The process of claim 15 wherein contacting the feed stream with the catalyst comprises passing the feed stream over the catalyst at a space velocity from about 150,000 to about 10,000,000 NL/kg/h.
28. A process for the catalytic partial oxidation of a hydrocarbon feedstock, comprising:

(a) preheating a feed stream comprising a hydrocarbon feedstock and oxygen gas to at least about 350°C;

(b) passing the feed stream over an unsupported rhodium foam catalyst, at a space velocity from about 150,000 to about 10,000,000 NL/kg/h at conversion-promoting conditions comprising a pressure from about 500 kPa to about 2800 kPa wherein the conditions are effective to produce an effluent stream comprising carbon monoxide and hydrogen;

wherein the carbon selectivity for carbon monoxide is at least about 80% and the hydrogen selectivity is at least about 60%.

29. The process of claim 28 wherein the catalyst comprises a monolithic foam.

30. The process of claim 29 wherein the foam has 75-90% by volume pores and 20-100 ppi pore size.

31. The process of claim 28 wherein the hydrocarbon feedstock comprises at least about 50 % methane by volume.

32. The process of claim 28, further including pretreating the catalyst by exposure to air under conditions sufficient to oxidize the catalyst.

33. The process of claim 28 wherein the feed stream is preheated to about 400°C.

34. The process of claim 28 wherein the hydrocarbon feedstock contains methane and the molar ratio of methane to oxygen is from about 1.5:1 to about 2.2:1.

35. A catalyst for the partial oxidation of a hydrocarbon feedstock, comprising
a porous rhodium foam catalyst;
wherein the catalyst is adapted to oxidize the hydrocarbon feedstock with a hydrogen selectivity of at least about 60 %.

36. The catalyst of claim 35 wherein the foam comprises a monolithic foam.

37. The catalyst of claim 35 wherein the foam has 75-90% by volume pores and 20-100 ppi pore size.

38. The catalyst of claim 35 wherein the foam has been pretreated by exposure to air under conditions sufficient to oxidize the rhodium.

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